

CONTROL ELEMENT WITH A MECHANICAL ACTUATOR

BACKGROUND OF THE INVENTION

This invention relates to a control element with a
5 mechanical actuator and an electrical or electromechanical
switching element, whereby the switching element comprising
of at least one push button reacting upon pressure.

The present invention further relates to a hearing device
or hearing aid with such a control element with a
10 mechanical actuator and an electrical or electromechanical
switching element.

Control elements to be manipulated or controlled by the
user of a device from the outside of the device, such as a
hearing aid or a hearing device, are commonly provided in
15 form of potentiometers or toggle switches, for instance as
volume control. These control elements are provided as
complete units, that is the mechanical actuating element
accessible from the outside as well as the electrical or
electronically switching element are realized in one single
20 piece.

Such control elements are usually soldering attached
directly to the printed circuit board of the electronic
module of the device or are attached to this printed
circuit board by means of electrical conducting wires,
25 which connections are realized as well as soldering
connections.

For an economically manufacturing, such control elements
have to be mass-produced in standardized specifications.

Therefore, such control elements provide of identical electrical switching or control features respectively, but also provide a uniformed shape and color of the mechanical actuating elements.

- 5 If an actual control element has to be replaced in a hearing aid or hearing device respectively, the whole or complete control element has to be removed and replaced. For this purpose the hearing aid or hearing device has to be opened and the control element as to be desoldered,
10 which involves a great effort and operating expense. This further causes a great risk of damaging the other electrical and/or electronical components of the hearing device or hearing aid, especially if not performed by especially skilled persons.
- 15 This whole work has to be done even if not the electrical component of the control element has to be replaced due to a technical defect but if only the mechanical component, e.g. the mechanical actuator, has to be replaced. This may be the cause not only by technical reasons but also by
20 esthetical reasons.

SUMMARY OF THE INVENTION

- It is an object of the present invention to provide an
25 improved control element of which only the mechanical component, e.g. the mechanical actuator, may be easily replaced.

The present invention provides a control element with a mechanical actuator and an electrical or electromechanical switching element, whereby the switching element comprising of at least one push button reacting upon pressure and
5 whereby the actuator is arranged elastically or resiliently reloctable or tiltable with respect to the switching element or the push button respectively and that further an actuating cam is provided at the actuator facing the push button, whereby the actuator and the switching element are
10 not directly connected to each other. The dividing of the control element into two parts, one mechanical actuating part and one electrical switching part, permits the replacement or exchange only of the mechanical actuating part without any influence to the electrical switching
15 part. The replacement or exchange therefore may take place without the need of desoldering of the electrical switching part from its printed circuit board or from its connected wires.

In one embodiment, the switching element comprises of two
20 adjacently arranged, identically built up switching elements connected to each other, each of them comprising one push button. The switching element may thus be built up with known switching technology, for instance with a commonly used micro electrical switching component for
25 reliable and consisting switching functionality.

In another embodiment, the push button comprises of a micro switch, a rubber mat with contacting elements or a twistable punching element. Reliable known electrical

switching components may thus be used for the control element.

In a further embodiment, the switching element is arranged on a printed circuit board and may further be soldering
5 connected with conducting paths of the printed circuit board. The switching part of the control element may thus be pre-manufactured whilst fitting the printed circuit board and may further be tested before its assembly into the housing of the hearing device or the hearing aid. Thus,
10 a stable and reliable electrical conducting connection of the electrical or electronical components to be controlled by the control element will be obtained.

In a further embodiment the actuator consists of plastics, with an open resilient profile for a snapping connection
15 with support elements arranged above or laterally of the switching element. The actuator may thus simply be attached and engaged onto the support elements. A simple and easy subsequent replacement of the actuator after its assembly with the device is therefore possible, by unclipping the
20 actuator from its support. The resilient or snapping profile preventing of being unintentionally or independently loosen from the support elements.

In a further embodiment the actuator is having a concave recess towards its operation side. The actuator may thus be
25 easily and secure operated even in miniaturized size, without the need of having visual contact with the actuator.

In another embodiment the actuator is having a tongue protruding to the outside, with concave or convex recessed

grip on one or both sides. The tongue provides a leverage effect onto the actuator, and may therefore transform a low force push or pull action into a rocking action of the actuator for activating the push button of the control element.

In a further embodiment the actuator is having both a first contact surface arranged substantially parallel to the push button and a second contact surface arranged substantially perpendicular to the push button and having a rounded shape. A push movement of the actuator may thus for instance be used for the increment of the volume of the hearing device and a pull movement for the decrement of the volume. This may be of an ergonomically advantage, as the pull movement as a rule may be performed quicker and more easily and without the need of visual contact to the actuator then the push movement, and the reduction of a high volume is usually a matter of urgency in contrary to the increasing of the volume.

In a further embodiment, the first contact surface may further comprise of a concave cavity and the second contact surface may have at least partially a cylindrical shape. The concave cavity facilitates the sensing of the actuator without any visual contact to the actuator. The cylindrical shape facilitates a pulling action with the inside of a finger, as well without the need of having visual contact with the actuator.

In a further embodiment the actuator is having a tilting axis, which is formed by a pin arranged above the push button, and whereby the actuator is detachably attached to

the tilting axis. A reliable and break-safe supporting of the actuator may thus be provided, which is easy and cost efficient.

In a further embodiment the actuator is provided of a
5 flexible cover putted over the actuator. The flexible cover may consist of rubber or rubber like material. On one hand, the grip of the actuator is increased, and on the other hand, the control element is protected against environmental influences such as wetness, humidity, sweat
10 and dust. This cover may be provided directly onto the housing by use of multi-component technique, thus providing a seamless sealing of the opening of the actuator in the housing of the device.

The present invention further provides a hearing device or
15 hearing aid with a control element with a mechanical actuator and an electrical or electromechanical switching element, whereby the switching element comprising of at least one push button reacting upon pressure and whereby the actuator is arranged elastically or resiliently
20 reloctable or tiltable with respect to the switching element or the push button respectively and that further an actuating cam is provided at the actuator facing the push button, whereby the actuator and the switching element are not directly connected to each other for the controlling of
25 features of the hearing device or hearing aid respectively. By the combination of two electrical switching elements pure switching actions may be performed as well as control actions of the electronical modules of the hearing device or hearing aid. A short push movement onto a push button

may initiate an impulse, whereas a long push movement onto a push button may initiate a pulse string or a continuous signal, which may be analyzed within the electronic unit of the device.

5 In one embodiment the controlled features comprise a volume control and/or a switching of different program modes. Such a control element is adapted to control the volume of such hearing devices or hearing aids, such as behind-the-ear hearing aids, and may be manipulated easily and reliable
10 even by motor limited persons.

In a further embodiment the switching element is connected directly with a printed circuit board of an electronic module of the device at the inside of the housing, whereby the actuator is protruding at least partially to the
15 outside from an opening of the housing of the device. The switching element may thus already be pre-manufactured together with the printed circuit board and standardized elements may be used. An actuator adapted to the shape of the housing individually manufactured or adapted to the
20 specific needs of a specific user of the device may subsequently be inserted into the device.

In a further embodiment a support for the actuator is arranged within the housing of the device in form of a tilting axis. Thus preventing any force acting onto the
25 actuator by the user to be carried directly onto the switching element and therefore onto the printed circuit board.

Other embodiments of the control element have already been described above and may be used as well in hearing devices or hearing aids.

5 The control elements of hearing devices or hearing aids according to the present invention may be easily and cost efficient adapted to individual needs with identical functionality. Thus an adaptation of the visible part of the actuator to optically or ergonomically aspects for new hearing devices is possible as well as a replacement of the
10 actuator for existing hearing devices, i.e. for an alternative user handling or alternative shape or color.

DESCRIPTION OF THE DRAWINGS

15 For purpose of facilitating and understanding of the invention, there is illustrated in the accompanying drawings of embodiments thereof to be considered in connection with the following description. Thus the invention may be readily understood and appreciated.

20 Fig. 1 is a schematical side view of an inventive control element assembled within a hearing aid;

Fig. 2 is a schematical side view of an alternative inventive control element;

25 Fig. 3 is a schematical side view of another alternative inventive control element;

Fig. 4 is a view of a hearing aid with the control element according to figure 3; and

Fig. 5 is a schematical sectional view of the control element according figure 1 with a flexible cover.

DESCRIPTION OF SOME EMBODIMENTS

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Referring to figure 1, the schematical cross sectional view of an inventive control element 1 is shown installed within a hearing aid 2. The control element comprises of two adjacently arranged switching elements 3 and 4 attached to each other.

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The switching elements 3 and 4 respectively have a common layout and have push buttons protruding to the outside. The switching elements 3 and 4 respectively may be micro switches or switch components with a rubber mat as push button 5 and 6 respectively. The switching elements 3 and 4 may as well comprise of electrical conductive, twistable punching elements. The switching elements 3 and 4 are electrical electroconductive connected with the printed circuit board 7. They may be directly connected to the printed circuit board 7 by soldering and thus as well establishing a mechanical connection.

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The mechanical actuator 8 is arranged above both of the switching elements 3 and 4, e.g. in form of a rocker with a tongue protruding to the outside, as shown in figure 1. The actuator 8 is tiltable around its axis 9 in both directions, whereby neither the axis 9 nor the actuator 8 is directly connected with the switching elements 3 or 4. Known resilient elements or stop elements may further be

provided to set the actuator 8 in its rest position or to postpone the actuator 8 to its rest position.

The actuator 8 has actuating cams 10 and 11 directed to the push buttons 5 and 6, which may contact and actuate the
5 push buttons 5 or 6 respectively by tilting the actuator 8 around its axis 9 and thereby initiate the switching operation.

The tongue of actuator 8 shown in figure 1 has a convex recessed grip 12 on both sides of its surface. The surface
10 of those recessed grips 12 may be provided with additional ribs or a rough structure for a better grip or may be coated with a grip coating.

The tongue may easily and safe be handled with the inner side of a finger whereby only a light push or pull action
15 has to be performed for the switching action.

An alternative embodiment of the actuator 8 of an inventive control element 1 is shown in figure 2. The switching elements 3 and 4 are identical with respect to figure 1. The actuator 8 is provided as a simple rocker with concave
20 rounded surface towards its operation outwardly face. The actuator 8 does not have a defined or physical axis but is guided movable within the housing of the hearing device 2. The rest position of the actuator 8 shown in figure 2 may be assured by means of spring elements (not shown in figure
25 2). The upper or lower switching element 3 or 4 respectively will be activated by pressing or pushing onto the upper or lower part of the actuator 8. A By pressing onto the middle part of the actuator 8 both switching

elements 3 and 4 may be jointly activated and thus a joint switching action may be initiated.

A further alternative embodiment of the actuator 8 is shown in figure 3. The actuator 8 is provided in form of a rocker
5 with a fixed tilting axis 9 analogue to the embodiment of figure 1. A protruding body with partly cylindrical shape is provided instead of the tongue of figure 1. The upside rim 8' has the shape of a half-cylinder and is easy and reliable tangible with the inner side of a finger, and by
10 pulling this rim 8' with the finger a switching action of the lower switching element 4 will be initiated. By pressing onto the face part 8'' or onto the tilted ramp part 8''' of the actuator 8 a switching action will be initiated by the upper switching element 3. The different
15 functions of the hearing aid associated to those different actuating actions will thus easy be learned and memorized by the user of the hearing aid and may be reproduced with a lower error ratio.

The view of a behind-the-ear hearing aid with an inventive
20 control element according figure 3 is shown in figure 4.

The embodiment of the control element according figure 1 with a cover 13 putted over the actuator 8 is shown in figure 5, thereby sealing the opening for the actuator 8 in the housing of the hearing aid 2. This cover 13 prevents
25 any dirt or humidity from penetrating into the housing of the hearing aid 2.

One advantage of the inventive control element lies in the fact that the actuator 8 may be assembled or replaced without the need of opening the housing of the hearing aid

2. The switching elements 3 and 4 are not affected by such assembly or replacement activities and may be left onto the printed circuit board 7 untouched. Thus, standardized elements in identical shape and function may be used as
5 switching elements 3 or 4 respectively with positive influence onto the production costs, and however individually shaped or adapted actuators 8 may be used. Such customized adapters 8 may be economically produced even in small numbers.